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ABSTRACT

In order to adapt new technologies and special processes to the particular conditions of developing nations, the German Appropriate Technology Exchange (GATE) was established in 1978 within the German Agency for Technical Cooperation (GTZ). This document traces the major aspects of cooperation between the Federal Republic of Germany and its partners in developing nations in the field of technology transfer. Examples of cooperative effort and successes in solving problems of developing countries are documented in this issue. Given the large number of different approaches and local conditions in these countries, transfer of technology had to be scrutinized against the specific economic, ecological, social and cultural background of the country in question and must be tailor-made. Pressing needs for many developing countries include more effective transportation systems, modern data evaluating and processing techniques, energy supplies, drinking water of proper quality, and sanitary facilities. The West German federal government has made the improvement of water supplies high priority within the framework of its political cooperation. The goal of the Federal Republic of Germany is to help the developing countries in scientific-technological cooperation as well as to train and implement study programs, so that these countries can master new technologies and gradually take over the production of technical products themselves. (SM)

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BRIDGE BUILDING BETWEEN NORTH AND SOUTH

Applied Technology for the Third World

by

Friedhelm Mensing

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The Transfer of Technology as a Contribution to Development

The transfer of technology and know-how has been going on since time immemorial. Exchanges between regions, countries and continents have always existed, had a mutually beneficial effect and contributed to progress. Countries and continents, which nowadays belong to importers of technology, have supplied Europe with knowledge and technology in past centuries. The Old World profited in particular from the transfer of knowledge from the Arab countries. The example Japan clearly shows how things have changed of late: within the course of a few decades, Japan has switched from being an importer to one of the major exporters of technology.

However, the transfer of knowledge has not always been without its problems and today there are also many critics, who would dearly love to see only the simplest technologies exported to the Third World and who reject strictly, the transfer of advanced technology.

Given the large number of entirely different approaches and local conditions, there is no generally valid response to the question whether the transfer of advanced technology or straightforward technology to the countries of the Third World is more advisable. Each transfer has to be scrutinised against the specific economical, ecological, social and cultural background of the country in question and must be tailormade.

The technology resulting from the artisan tradition of the industrialised countries of the 1950s and 60s, initially offered a whole range of associations with traditional knowledte and skills in the Third World. The new generation of technologies - for instance, micro-electronics or biotechnology - can, however, only be taken over and further developed by the so-called threshold countries, which have already created a proper basis through a long-term technology and science policy. Technologies, which for example, are thoroughly suitable for the Argentine or Brazil to overcome certain problems, would turn out to be false investments in certain African countries.

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Often it is the practical field test that first reveals the difficulties and resistance encountered through the introduction of new technologies. It is essential, however, that the population of the developing country in question accepts such projects so that as many people as possible can benefit from the "imported" technology.

The concept of "medium" or "applied" technology, which was developed more than 15 years ago, does not offer any overall satisfactory solution either on account of widespread psychological and political prejudices against the "old clothes of the industrial countries". In some developing countries, it is felt that by accepting such a concept alone, the gap in productivity to the industrial countries can never be closed. In addition, the claim to sufficient employment for several hundred million jobless in the Third World which is tied to the concept, could never be fulfilled.

As a consequence, there was no wide acceptance of applied technologies. Nonetheless, "medium" technology is the correct approach for coming to terms with the basic needs and adjusting to the special production conditions in developing countries. Based on this, the German Federal Ministry for Economic Cooperation (BMZ) developed the concept of "situation-oriented" technology, which in contrast to "applied" technology does not pursue a determined technical level.

However, with this "new technology", not only technics are to be transferred but also an individual, usually somewhat more modest development process is to be set in motion. Solar pumps for example, can be used for decentralised drinking water supply or plants for electricity supply using renewable or local sources of energy improve living conditions and help rural development. Modern technics serve to build up the infrastructure on the communications and transport sector or for waste and sewage disposal. Ecologically compatible production and processing methods enhance the prerequisites for industrialisation - making careful use of local resources.

In order to adapt these technologies and special processes to the particular conditions of the Third World, the German Appropriate Technology Exchange (GATE) was set up in 1978 within the German Agency for Technical Cooperation (GTZ). GATE is the hub for the major potential provided by the research institutes within the Federal Republic of Germany and their know-how to the advantage of the developing countries.

So that no new one-sided dependence in the technological field is created, the Federal Republic of Germany helps the developing countries in the form of scientific-technological cooperation as well as training and further study programmes to master new technologies in the long term and gradually to take over the production of technical products themselves. Within the scope of the cooperation between the Federal Ministers for Technology and Research (BMFT) and Economic Cooperation (BMZ) the BMFT programmes for the developing countries (more than one hundred million DM has been allocated since 1979) and the measures of the BMZ are harmonised. The joint "working group" - the interministerial coordination centre, is involved in steering the cooperation which has existed since 1976 - right down to country-by-country specifications.

This IN Special is intended to trace the major aspects of cooperation between the Federal Republic of Germany and its partners in the Third World in the field of new technologies and to illustrate this by examples.

Faster, more effective, cheaper - traditional and new Means of Transport for the Third World

Cracked and corroded girders and frames - only rust appears to hold together the old pedestrian bridge which is used by many hundreds of people every day above the rails at the Maradana Station in Colombo. According to German safety engineering standards, the bridge would have been closed long ago.

Many other railway bridges in Sri Lanka, dilapidated structures from the long-gone days of British colonial times, are as bad if not worse. In the interim, the German Agency for Technical Cooperation (GTZ) with an allocation of 8.5 million DM is engaged in preserving and modernising up until 1988, the around 2,000 railway bridges of all dimensions on the island.

A large number of African countries are faced with similar problems. The Federal Republic of Germany is thus engaged in setting up and modernising railway lines in Senegal, the Ivory Coast and Togo. As in these countries, mostly relatively transport-intensive branches of industry dominate, such as agriculture, mining and basic materials, a well functioning and modern railway network - an adequate goods transport system is essential. However, in many developing countries, the railways were neglected for many years in favour of road transport so that nowadays, many far-reaching redevelopment projects are required on lines which mainly originated in colonial days.

The car and road-building has been accorded priority in Africa in particular. From Dakar to Dar-es-Salaam, bush taxis are underway, lorries supply remote regions, new roads are constantly being driven through desert, savanna and the bush. Usually though, the money available to take care of the existing road network is not enough so that the state of the roads south of the Sahara is constantly getting worse.

Only in a few countries, such as the Ivory Coast, Cameroun or Nigeria, is there enough money available for road maintenance to secure the existing road system. According to a World Bank survey, given the same amount of new road-building activity, total expenditure for the network of highways in Sub-Saharan Africa would have to be increased by around 750 million dollars from the current 3.8 billion dollars. An additional 15 billion dollars, it is estimated, would be needed to repair road damage. In view of such impossible sums, most African countries have only the possibility of concentrating existing funds more on maintenance and putting off new projects. Bad roads not only lead to high fuel and lubricant consumption, but also to increased tire-wear and enormous repair costs.

In view of the generally poor state of the roads, the German Agency for Technical Cooperation (GTZ) is involved in lorry projects in Ethiopia, Burndi, Malawi, Zambia and Swaziland and bus projects in Sierra Leone, Guinea, Zaire and Sudan in order to adapt the vehicles to African conditions.

The poor roadways and frequent overloading mean that robust vehicles are required. In addition, the ground clearance of European buses is usually not sufficient for African conditions. The seating must usually be completely changed, roof loading facilities have to be made available and the ventilation for the passenger area has to be improved.

A special kind of technical advisory project in Tanzania relates to adding carosseries to imported chassis. The basis is provided by a cross-country lorry chassis, upon which a body suitable for local conditions is set. In some cases, the bus parts are made locally, something which indicates that certain African countries are making efforts to establish their own bus industries.

However, as experience from various, even further developed countries has shown, African industry will still depend for some time on the know-how and supplies from the industrial countries. Within the framework of a general project involving the German Federal Minister for Research and Technology and the Minister for Economic Cooperation, initially the prerequisites for German-African cooperation with divided labour for the motor vehicle industry is being explored. The aim of corresponding pilot projects is to develop design and production concepts together with African partners for robust, foreign exchange saving types of buses, adapted for African operating conditions.

Whereas railways, lorries and buses form the backbone of the transport system on the African continent, sea transport is of enormous importance for the development of the Republic of Indonesia with its 13,611 islands. Modern coastal motor ships play between the main ports of the island country, which spreads over more than 5,000 km from east to west and some 1,500 km from north to south. Regional sea traffic is carried out by wooden motor vessels and even today, 10 to 20 per cent of the overall passenger and goods traffic of the country is carried by traditional sailing ships known as "praus".

In order to improve inter-Indonesian sea traffic, especially at regional level, the Federal Republic of Germany is engaged in a joint project with the Indonesian Minister of Research to develop modern wind-driven freighters. As the Java Sea is a region with good weather conditions and average wind speeds of around ten knots as well as relatively slight wind fluctuations, relatively large sail areas would be required in order to ensure progress in the event of low wind strengths. For safety reasons, a motor was necessary so that "motor-supported sailing ships" have been developed, which enable fuel savings of 75 to 95 per cent.

The INDOSAIL 64/1 version for instance, with a length of 64 m, a capacity of 1,400 tonnes and a sail area of 1,700 m^2, has been able to achieve a higher sailing speed of around 25 per cent more than the famous school sailing ship of the German Navy, the "Gorch Fock", which has practically the same water displacement and a larger sail area - thanks to its sail rigging which was developed in the Federal Republic of Germany, Countries with similar geographical, climatic or economic conditions - such as India, Sri Lanka and the Philippines - are showing interest in this efficient and oil-saving transport system.

The HELITRUCK, a modern airship, a joint German-American development, is also of interest for a number of developing countries. The new "lighter-than-air" transporter is a rigid airship, which carries almost its entire empty weight,thanks to the static upthrust, whereby 90 per cent of the rear drive is available for carrying the payload. Air speeds of up to 200 km per hour show there is no comparison with conventional, slow-moving airships. HELITRUCK, which in comparison to other air and land vehicles places no demands on the infrastructure and in addition, is extremely thrifty in terms of energy consumption, could make a considerable contribution towards improving goods and passenger traffic in many flat countries of the Third World.

The method is as bold as it is lucrative - and the authorities in various countries have seen it happen. "Wild settlers" occupy a piece of land, have it entered into the local land register as belonging to them and attempt to sell it only a few days later. Soon they move on, to try it all over again: occupying a piece of land, having it entered in the register and then selling it... Of course, the method is illegal but such a crime can hardly be punished if there is no nationwide coordination among the land registry offices.

Such criminal goings-on can only be prevented providing that land registries are linked together by computer and cooperate closely in order to clearly determine just who owns what.

Backward and inefficient administrative structures in many Third World countries still obstruct long-term development planning. The lack of precise cadastres, as well as data on raw material reserves, soil utilization, social structures, environmental indicators, etc., can lead to the wrong sort of planning with serious economic consequences. However, there is more to it than just collecting data; for modern methods and electronic data processing are needed to collect, document, process and interpret the mass of individual pieces of information. Jotted-down notes, antiquated files and slide-rules for instance, are no longer enough for town planning in view of the rapid growth of the cities in the Third World.

In Sri Lanka, modern data evaluating and processing techniques are intended to make the country self-sufficient in foodstuffs in the foreseeable future. Although practically all the arable land is cultivated, not enough food is produced today to satisfy the need of the around 16 million inhabitants of the South-East Asian island country. In the long term, only the increase of yields per hectare can bring about self-sufficiency.

A central data bank in Colombo as well as data banks in the nine provincial capitals of the country, are to collect the relevant data on precipation, temperature and fruit patterns and process them in order to provide agriculture with a better basis for planning. However, by means of this new technique

the long-term intention is to tackle environmental problems, improve the infrastructure of the country and carry out ground-classification measures, establish land registries and start the intensive mapping of the island.

So that the technical plant can be operated by local staff, the Federal Republic assists by providing training and refresher courses for planners, surveyors and data processors. Experts from four South-East Asian countries take part annually in courses held by the German Foundation for International Development (DSE) on surveying methods and modern data collecting and processing techniques. Apart from Sri Lanka, Thailand, Nepal and Malaysia are attempting to master similar problems with the assistance of new data techniques.

Data technology has also been an important part of German-Egyptian cooperation since 1984. Priority is given to know-how transfer for the designing and utilization of information systems in companies, public administration and state holdings. The Federal Republic of Germany is cooperating with Brazil particularly in the field of computer science, micro-electronics and industrial automation. Intensive contacts in the field of information technology also exist with South Korea.

The possibilities for developing countries to use satellites are also growing constantly. Since 1985, the Food and Agricultural Organisation of the UN - the FAO - has maintained a drought warning system, based on the European space satellite Meteosat and the satellite Landsat-5. Permanent observation from space enables experts to predict agricultural catastrophes and to trace them. The endless stream of computer data can also call the attention of observers to changes in ecological conditions, which for instance, benefit further encroachment of the deserts.

In addition, most developing countries nowadays are linked to the international communication network through INTELSAT. Operating one's own satellite or the partial using of communication satellites, as for instance, the oceanographical satellite ERS, is currently beyond the financial resources of practically all developing countries, so that for the time being they will only be used by a few threshold countries. As a result, the Federal Republic of Germany's scientific-technological cooperation is focused on providing access to such technology through training experts and reconnaissance seminars, especially for agricultural purposes.

Wood is becoming scarce

Freshly-baked nan for lunch and supper; nan from the evening before for breakfast - the unleavened bread made from maize flour traditionally belongs to every meal among the Pakistanis and Afghans. The baking of such bread in a tandoor, a container which is either set in the earth or covered with a thick layer of mud - and heated from above - is also traditional but at the same time wastes a lot of energy. The dough, which the women press against the heated walls is ready after about a minute.

When you bake things in this way, most of the heat is lost through convection so that on average, only about 92 nan can be baked using 15 kg of wood. Using the new semi-circular tandoor, which is promoted by the German Agency for Technical Cooperation (GTZ), 300 nan can be baked using only 13 kg of wood. In other words, 120 grammes of wood are saved per nan. If you consider that around 70 per cent of the energy used in Afghani refugee camps - almost entirely firewood - is used for baking such bread and that Afghani and Pakistani village bakeries also use this energy-expending method, then it is not difficult to imagine how much wood could be saved.

Energy-saving is one aspect, the increasing use of renewable sources of energy the other aspect of a strategy, which the German Federal Government is pursuing with special energy programmes in countries such as Burkino Faso, Menya, Columbia, Peru, Sudan, Tanzania and elsewhere. Within the scope of this programme, developing countries are supported, which have particularly to suffer on account of a scarcity of traditional fuels - particularly firewood - as well as the costs of importing oil.

In Kenya for example, a whole series of individual measures are used to "tap" renewable sources of energy such as the sun, wind, water and biomass in order to provide remote rural districts in particular with energy. The spread of energy-saving wood ovens and more efficient charcoal producing methods represent further means of countering the acute lack of firewood in many developing countries.

According to FAO estimates, excessive exploitation of wood resources has led to acute scarcity and immense rise in the cost of the fuel in 25 Third World countries; a further 30 in the meantime report considerable deficits. More than 1.4 billion people are affected by the firewood crisis, even greater sums for firewood and charcoal eat into their incomes; and those who are self-reliant have to cover ever greater distances in order to collect their supplies.

In view of the enormous importance of sufficient supplies of energy for the development process, the Federal Republic of Germany has traditionally accorded this sector high priority; the main countries in terms of bilateral cooperation in this field have so far been Egypt, Bangla Desh, Burma, Brazil, India, Pakistan, Sri Lanka, Syria, Thailand and Turkey.

"Black Gold" - Coal is still available

Sipho gets up shortly before dawn. She has to fetch water, make breakfast for her four children and then work hard in the fields from six in the morning till six in the evening, with just a short break for lunch in between. On the way home, she fetches water and collects firewood. However, this is taking up ever more time in Sipho's 16-hour working day; for in Matebeleland, south-east of Bulawayo, there is hardly any wood available for cooking purposes. Sipho cannot afford charcoal.

The same situation applies in many other regions of Zimbabwe - Matabeleland is not unique regarding a lack of firewood. For the amount of forested areas dropped from 60 per cent in 1960 to 30 per cent in 1980.

However, Zimbabwe, like its neighbours Botswana, Mozambique, Zambia and Tanzania possesses considerable reserves of energy. Around 60 per cent of all African coal - excepting the giant deposits in the Republic of South Africa - are to be found in these countries. They could be a favourably-priced alternative to expensive imported oil and relieve the pressure on the dwindling forests as a source of energy.

Apart from the countries in the south of Africa, brown and hard coal could contribute considerably more to energy supplies above all in Bangla Desh, Brazil, India, Columbia, Korea and the Philippines, as all these countries have major reserves.

Even in mineral oil exporting countries such as Mexico, Iran and Venezuela, "black gold" is capable in many places of replacing expensive domestic oil as a favourably priced alternative; after all, the costs and risks of prospecting for and opening up coal reserves are considerably lower than for oil. In addition, coal mining is more labour-intensive than oil production - and in view of the high rate of unemployment, particularly attractive for the states of the Third World for their overall economy.

Today, coal only covers around 16 per cent of the commercial energy consumption of the developing countries, although it is estimated that up to 15 per cent of the world's accessible and economically exploitable current coal reserves are located in these countries - equal to a hundred times the present annual oil consumption. Some 28 countries possess coal reserves which remain unused - and in a number of other countries there are traces of coal without further prospecting actually being carried out. As a result, stepped-up efforts to prospect for and open up deposits as well as to train experts are necessary.

This is also where the help provided by the Federal Republic of Germany comes in. In Haiti, funds made available by the Bonn Government are being used to prospect the Maissade brown coal reserves; execute an "individual study on Coal Prospecting in Northern Somalia" and Germany is also involved in Columbia and the Philippines with exploration projects, intended to improve the energy supply in the long term.

In addition, many countries are being advised and supported in modernising their coal mining industries; India, for instance, with the introduction of hydraulic support systems in the mines at Gopalischuk.

Furthermore, many developing countries profit from the long-standing experience of Germany as a "coal mining nation" for refining and the more effective utilization of coal. In Brazil, a Technical Cooperation energy project is being sponsored, which serves to improve the production of coke from Brazilian coal.

An agreement to create wood substitutes from coal was signed with Zambia in 1982. The German Federal Government is promoting a project resulting from this agreement at the Maamba coal preparation plant, in the scope of which smokeless fuels with the characteristics of charcoal are produced from the waste resulting from coal refining.

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Coal itself is not normally suitable as a fuel in Zambian households as domestic coal there contains a high amount of sulphur, which courses an objectionable smell. Furthermore, burning the coal calls for special and expensive ovens. By preparing slurries and the middlings in the form of fine coal, it was, however, possible to produce an economically sound, smokeless wood substitute through briquetting as well as the subsequent pyrolysis of the "green briquettes" won in this way.

The positive results of this project are of great importance for the whole of southern Africa - and the coal-producing nations of South America and South-West Asia are beginning to show an interest in the "green briquettes". This is understandable for this wood substitute is smokeless and odourless, does not require a special oven and is suitable for transport over long distances thanks to its water resistance and hardness. In addition, "green briquettes" are considerably cheaper than charcoal.

Solar Energy - inexhaustible and environmentally friendly -

Their traditional maize beer is the sole "luxury", which the Indios of Peru on the Altiplano permit themselves on public holidays. Otherwise, they lead a hard and frugal existence. They work smallholdings and farmsteads at an altitude of 3,000 m, where maize, wheat, barley and potatoes scarcely grow so that they also raise cattle on the mountain pastures, the Páramos.

Like in other mountain regions of the Third World, the lack of energy supplies, infrastructure and communal facilities also restrict the working and living conditions of the Indio mountain peasants. For the time being, it seems there is hardly a chance of them being connected up to the electricity network.

As an essential contribution to improving their quality of life, to "restoring their dignity" is how the Indios of the region around Puno regard the development of "mini solar systems" through the German centre for development technologies. This centre - known under its English name "German Appropriate Technology Exchange" (GATE) - is a division within the German Agency for Technical Cooperation (GTZ). There is a big demand for these mini systems with an output of 40 Watt.

Thanks to interposed batteries, the solar cells are in a position to supply the power required for lighting for a whole family and also to replace dry cells, for instance, in radios. However, the sun's energy is not simply "tapped" for private consumption, but also for health centres, village community facilities and public telephone cells.

Flickering candlelight and inadequate kerosene lamps belong to the past in many Indio families; with the new "solar light", nowadays following work in the fields, in the evenings, school homework is done, materials made and dresses repaired.

Silicon discs, which are made from simple quartz sand are needed to make solar cells. Today, they supply the energy required for water pumps, radios or televisions in many sun-blessed regions of our earth. They supply the power for weather stations, telecommunication and health facilities.

Around 300 days of sun - almost twice as many as in the Federal Republic of Germany - are registered in an average year in the Hashemite Kingdom of Jordan. Nonetheless, the country lacks energy sources: Jordan relies almost entirely for its oil imports on Saudi Arabia. The desert country's oil bill is already considerably higher than the value of all the goods it exports.

For many Jordanian settlements, there would still be no chance of being provided with enough drinking water if the sun did not supply free energy, which desalinates sea water. Today, there is a sea water desalination plant operating at the coastal town of Akaba. At the other end of the Red Sea, in Egypt with similare energy problems, solar sea water desalination plants contribute to improving drinking water supplies. The plants are produced by the Egyptians themselves - as in Jordan, tried out and adapted to the specific conditions of the country by the GTZ -in collaboration with the Dornier System GmbH, Friedrichshafen.

However, solar energy can be used for other purposes as well: for even although it may sound paradoxical, "heat from the sun" can also be used for cooling purposes. In the Egyptian capital, Cairo, for instance, solar energy is used to cool down a warehouse set up with German help to a constant eight to twelve degrees Celsius.

The plant which is equipped with a collector area of 23 m^2, supplies a cooling output of three KW and serves the temporary cooling or the fresh-keeping of foodstuffs.

The conversion of solar energy into electricity through solar cells is particularly suitable for supplying rural, thinly populated areas. It can also be expected that the purchasing costs will continue to fall thanks to constant improvements and the start of series production. In this way, a once-off investment will require an ever decreasing time to amortise itself through savings in diesel fuel, kerosine and other sources of energy.

The Return of the Windmills

The first Portugese colonialists divided the ten larger and five smaller Cape Verde islands into those above and below the Passat wind - the barlavento and sotavento islands. But whether up or down wind, there is always a strong breeze blowing day-in, day-out, over the group of islands off the West African coast. With the aid of this permanent, strong wind, efforts are being made to counter a major deficit on the Cape Verde islands, a lack of water. There is only enough rainfall for the scanty agriculture on the islands during the rainy period, between July and December, providing the south-western inter-tropical front moves far enough north. If these major climatic conditions fail to come about - something which has happened frequently over a number of successive years - drought and the threat of famine are the consequence.

Long-term measurements by the German Agency for Technical Cooperation (GTZ) have revealed that sufficient water, which is favourably priced compared with that obtained via conventional diesel pumps, can be supplied for the population and their animals as well as for irrigating the fields by using traditional windwheels as well as wind turbines. In this way, the periods of famine which occurred regularly in the past would finally be combatted; in addition, thanks to a safe water supply, the long-term economic developments of the island country in the Atlantic could be decisively influenced.

For thousands of years, wind energy has been used to drive sailing ships and windmills and to deliver water, however, it was not untill we were forced to react to the oil crises of the 1970s that wind energy - almost forgotten although it costs nothing - experienced a rennaissance. Nowadays, modern but simple wind wheels

with a rotor diameter of only five metres are capable of providing 500 people with drinking water from a depth of 15 metres - of irrigating a hectare of land from a depth of five metres. This hectare of irrigated land suffices to feed four to eight persons. As wind as a source of energy, however, greatly depends on local conditions, wind measurements are required over a lengthy period before a decision can be taken relating to whether or not a wind energy plant can be set up in the one or other developing country so that it fulfils its purpose economically. Only in this way, can such plants be chosen properly and adjusted to suit local requirements in order to avoid inadequate utilization or perhaps, damage caused by excessively strong winds. The number of rotor blades for such a modern "windmill" can vary between 6 and 24; the form and arrangement of the blades and the height of the wind mast also differ.

However, nowadays wind energy is not only used for supplying water and for mechanical work, but also increasingly to produce electricity. Technically mature small wind power plants are in a position to supply private households and communal facilities with the necessary energy for heating and lighting purposes. And like the other renewable sources of energy, like the sun, water and biomass, wind energy is particularly suitable for decentralised energy provision. As a result, German Development aid within the framework of the Special Energy Programme backs a combination of the various sources of energy corresponding to local conditions in the given developing countries. In Kenya for instance, two wind wheel versions "Made in Kenya" are used for supplying water in the "wind-favoured" coastal districts of Lamu and Kilifi as well as in Turkana and Marsabit in the north of the country. They are constructed by local manufacturers with German help and have been adapted to suit the conditions there. "Kijito" wind wheels made by the firm BHEL in Thika for instance, can compete with imported wind wheels both technically and in terms of price and are especially suitable for the entire East African market as a result of their simple manner of construction and low maintenance costs.

Biomass - Energy for One's own Consumption from Heaps of Waste

Formerly, every evening at Bowman's Farm, you went to bed more or less when the hens did; for the farm in La Croix is not connected up to the electricity supply network of the Caribbean island of St. Vincent. Only on rare occasions did the lamps which need expensive kerosine burn well into the night. Today, however, the eight-person household no longer has to depend on kerosine and butane gas for cooking. A biogas plant supplies the farm in the remote Mesopotamia Valley with sufficient and cheap energy.

The four cows, a number of sheep and the 200 chickens belonging to the Bowamans supply the material for the methane-based gas mixture. Apart from the excretions of animals, garden and kitchen waste as well as washing water are put into the 2-5 m^2 capacity collection tank, which transfers the resultant fermentation gases into a gas container. The biomass plant built with the help of the German Agency for Technical Cooperation (GTZ) supplies sufficient energy to prepare three meals a day for the family of eight persons, to bake bread twice a week - and light five hours a day as well. The family budget, which was formerly scarcely sufficient to buy clothes and to pay the children's school money, has been greatly relieved because kerosine and butane gas no longer have to be purchased. In addition, the plant produces high-grade natural fertilizer so that about 35 per cent of the mineral fertilizer previously used on the farm - mainly for the banana plantation - can be saved.

Like on St. Vincent, the GTZ and its division GATE (German Appropriate Technology Exchange) is involved in biogas propagation programmes in Bolivia, Burkina Faso, Burundi, Nicaragua and Tanzania in order to improve the energy supply of remote rural areas. Within the scope of the programme which began in 1982, today 12 to 14 GTZ development aid assistants are permanently engaged in ensuring that an energy potential which up till now has been largely neglected - biomass is made use of. In India alone, currently the world's greatest exploiter of biogas apart from the People's Republic of China and Korea, could obtain 7,500 Megawatt of electricity from the rice chaff produced every year during threshing if it were to be burned in specially developed power plants. These small, decentralised rice chaff power plants, according to the Indian state agency for industrial development in the north-west Indian state of Punjab, could be operated with 1,000 tonnes of chaff daily.

According to the American environmental study Global 2000, the world produces a huge amount of biomass every year (roughly 150×10^9 tonnes), which represent an enormous quantity of energy, only a fraction of which is utilized. In the USA alone, every year 122 million tonnes of all kinds of vegetable and animal waste could be used for producing energy.

Today, vast quantities of biomass are largely dumped or burned. Rice straw, cotton stalks, sugar-cane waste, the faeces of animals, etc. are not exploited for energy purposes. The same applied to the around 3,000 tonnes of coconut shells, which pile up at the national production centre for copra on the small island known as "Mafia Island" off the Tanzanian coast each year. Once the heap of waste was too big, it was burned - up until recently that is. Today, the semi-statal enterprise has a lucrative sideline thanks to German aid and technology: the biocoal produced from the coconut waste is sold in the markets of the capital 'Dar-es-Salaam for 3,000 Tanzanian Shillings per tonne.

"Water for Everyone"

In 1985, it appeared as if Egypt was faced with an apocalypsis. Experts felt that the water stored by the Aswan Dam was just sufficient to let the country survive the next year. If the drought had continued, the country's entire water and electricity supply would have been jeopardised and could have resulted in death through famine for many Egyptians. But even the end of the drought brought only short-term relief as far as the water situation is concerned, for the population in the land of the Pharoahs, which amounts to 48 million today will double by the year 2005. Agriculture in particular as well as industry and Egypt's tradesmen and craftsmen will constantly need more water. And not only the Egyptians will have to learn how to be more economical with the precious liquid. For the river and its tributaries are vital arteries for the countries on the upper reaches of the Nile as well.

Only three per cent of the water masses of our earth are fresh water. Of this three per cent, only a fraction is available to mankind: most of it is either frozen at the polar caps or is located in deep groundwater layers. The increasing shortage of water - above all, in many developing countries - can be attributed mainly to the rapid increase in population and to the fact that the relatively small amount of accessible water is often polluted or even contaminated and thus unsuitable for consumption.

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According to estimates by the World Health Organisation (WHO), only around 73 per cent of the urban population in the Third World and only 32 per cent of the rural have access to drinking water of proper quality. Only 53 per cent of city dwellers and 15 per cent of those living in rural areas have proper faeces disposal facilities available. Surveys carried out by the WHO have determined that around 80 per cent of all diseases are "water-related".

The ambitious aim of the International Water Decade - agreed on in Mar del Plata at the behest of the United Nations in 1977 - to provide the entire population of the world with enough drinking water of proper quality by 1990 can scarcely be achieved, especially as till then 1.6 billion more people in rural areas and 600 million people in the cities of the Third World have additionally to be catered for. Furthermore, the sanitary facilities for a further 250 million people have to be improved.

As a consequence, the German Federal Government has traditionally accorded the improving of water supplies high priority within the framework of its development political cooperation. The concentration of the activities in this field lies in Africa, where the securing of existing water resources is becoming increasingly important. As there are practically no data and statistics relating to exploitable potentials of surface and groundwater available, German assistance is mainly concerned with collecting the necessary data, in order to ensure that a long-term, national "water policy" can be drawn up in the given developing country.

Usually, suitable measures relating to sewage and faeces disposal are included in the projects relating to drinking water supplies - in order to ensure a permanent improvement in the hygienic conditions. Latrine-building programmes are particularly sponsored - and also recommended by the World Bank - as they afford major possibilities for the population to take part in their construction, operation and maintenance. In addition, in this connection there are preparatory and accompanying measures - courses and directions for the population so that the need for such projects is recognised and everything is done in order to keep the new drinking water and sanitary facilities clean.

For without enlightening hygiene instruction, drinking water projects can in fact have a negative effect on health as the intake of clean water dispenses with traditional immunity against certain diseases. If polluted water is drunk at a later stage, then the risk of becoming seriously ill is considerably greater than before.

In the "Water for Everyone" project - related to basic needs - of the German Agency for Technical Cooperation (GTZ) on Sri Lanka, all these basic considerations were taken into account and guaranteed its success. The GTZ's activities were aimed at ensuring that the inhabitants of the two poorest regions of the island country, Vavunija and Mullaitivu, were provided with proper water throughout the year - and especially during the dry period. Both districts in the north-west of the country with some 16 million inhabitants are located in the dry zone, where water supplies were often formerly catastrophic during the dry period. Most of the dug wells, from which some 30 per cent of families there obtained their daily water for drinking, washing, bathing and irrigating their gardens, dried up during this period. Sanitary conditions in the two districts were also bad: in Vavunija, only twelve per cent of the people possessed a latrine. A frightening number of cases of illness resulting from gastroenteritis (the main cause for the high child mortality rate), diarrhoea, jaundice and typhus was the inevitable result.

Initial attempts to extend the conventional wells through blasting were given up. Systematic explorations of the groundwater reserves revealed that only drilled wells, which reached down to the underground crevices of the rock formations could supply enough water.

As a result, more than 600 deep wells were drilled to a depth of 35 m, either by the "hammer-in-hole method" or by means of rotational drilling depending on the nature of the soil.

Only 27 of the more than 600 deep holes failed to achieve the 20 to 35 litres per minute - set as the minimum yield. Of the five types of hand pump tested by the GTZ, the Inhalsa MK II from India turned out to be the best; all of them operated perfectly and did not require frequent repairs. Today, villagers are responsible for their maintenance. The district development offices only need to dispatch one of the four pump mechanics in order to carry out major repairs.

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The farmer Selvarajah from the village of Nellukulam, however, not only has the advantage of the new wells but also of the latrine construction programme linked to the building of the wells. Within the framework of this programme, a GTZ grant of 300 Rupees was provided to all those who built the latrines up to their platform stage. Around 1,600 new toilets were created alone within the scope of this GTZ project.

In these two underdeveloped parts of Sri Lanka, the standard of living of the people has been improved decisively thanks to German aid - and one of the prerequisites for slowly catching up on the general development of the country was created. In the meantime, GTZ experts are drilling for water in the district of Kurunegala. Other German teams are helping in the Dominican Republic, in Kenya, Niger, Peru, Rwanda, Senegal, Sierra Leone, Zambia and many other developing countries to improve vital water supplies and to increase the quality of life of the people.

New Paths in veterinary Medicine

An old plague, which appeared to have been banished, is causing new terror: rinderpest, which has of late been registered again increasingly in Africa. Where it occurs up to 90 per cent of the infected cattle die. The "pestis bovina" is caused by a virus. Four to seven days after infection, the affected cow gets a high fever, then generally it is all over after two more agonizing days.

When rinderpest was registered in Chad in Africa in April 1983, forty per cent of the stocks of cattle were sick. Since then a million cattle have been lost. According to cautious estimates, around two million cattle have been lost in all developing nations up till now. In 1973, the situation was an entirely different one. At the time, the WHO's Annual Report on Animal Health registered prevalence of rinderpest in Mauritania only as well as occasional cases in a number of Central African states: Chad, Niger, Upper Volta and Mali. At the time, it was believed that the disease could be largely contained through vaccination campaigns - a mistake as experts soon discovered.

In contrast to Europe, where the disease - for example in Germany - has been conquered for the past 100 years - total combatting of rinderpest is not possible in Africa. A lack of infrastructure and frequently too, the nomadic way of life of the population have not permitted cattle stocks to be counted properly. The new concept now reads: control instead of destruction. However, control requires proper observation and this calls for a widespread network of veterinary services in each endangered country.

As a result, the German Agency for Technical Cooperation (GTZ) is involved with one hundred experts in more than 25 projects in 18 countries, mainly in Africa but in South-East Asia and Latin America as well. However, efforts are not merely being undertaken to control rinderpest, tape work diseases such as zystizercosis and echinococcusis in fattened livestock. In Bujumbura/Burundi, the Federal Republic of Germany is helping to combat the cattle disease - known as East Coast Fever - with Theileria parva. In the capital of Madagascar, Antananarivo, the GTZ in collaboration with the "Federal Research Institute for Animal Virus Diseases" in Tübingen and a budget of 1.9 million DM has helped to improve the production of vaccine decisively. Teschen Swine Paralysis for instance, can only be combatted by a specially produced formaline-inactivated vaccine.

By means of the "sterile male method" a joint Franco-German programme is engaged in eradicating the carriers of the dangerous malaria disease - trypanosomiasis, the tsetse fly. This method entails setting free male tsetse flies which have been bred in laboratories and sterilised by ray treatment. When a female fly, which can only mate once in its life, encounters a sterilised male then the female remains barren. In this way, a step-by-step reduction in the tsetse fly population is being arrived at. At the same time, harmful side-effects of ecologically dubious methods - as for instance, by making use of insecticides - are avoided.

Ticks are numbered among the dangerous foes of farm animals in tropical and sub-tropical countries; affected animals suffer from anaemia on account of the constant loss of blood as well as from skin damage and infections. However, the indirect consequences of being infected are even more dangerous: ticks pass on a large number of animal diseases, which can lead to high losses of livestock. In order to protect animals, they must be sprayed regularly with tick-killing solutions known as acaracides or dipped in them.

However, it was established a short time after the introduction of these methods of treatment some 40 years ago that certain types of tick developed immunity against the agents applied and subsequently became entirely resistant. A second problem is how to dispose of the large quantities of residual acaracides from the animal dips without harming anyone. Normally they are deposited on fields and considerably affect the sediments of the groundwater and drinking water obtained from wells.

As a consequence, experts have urgently called for the setting up of a World Acaracides (WARRC), which would be in Berlin (West) owing to the favourable location and the scientific prerequisites. The most important task of the WARRC, which can call on the resources and know-how of German research institutes and coordinate its operations with the German Agency for Technical Cooperation (GTZ), is the working out of a worldwide identification and monitoring programme for acaracide resistances and acaracide residue research.

In this way, new recognitions in this field would be directly available for the development of political cooperation of the Federal Republic of Germany and its Third World partners and contribute towards improving foodstuff supplies in the developing countries in the form of animal products.

With Biotechnology against Famine

When weaver birds are in search of food, they fly around in swarms and then suddenly drop - as if at one command - into a field of cereal, peck at the grains for a couple of minutes, rise like a black cloud before setting down again after covering a few metres in the air. As soon as one flock settles, another rises into the sky: for the observer there is the impression that a roller is slowly moving over the ground.

African farmers are well aware that this vision entails: many weeks of hard work were of no avail. The huge flocks of weaver birds, the size of sparrows - up to 15 million birds were counted in Sudan - cause considerable damage. Various measures have been undertaken to attempt to master this plague. But scarecrows, flame-throwers, gunshots, explosions and youngsters equipped with catapults, poised on small wooden platforms to guard the crops, are hardly any use at all.

Following many years of research and development, the experts of the German Agency for Technical Cooperation (GTZ) are now certain that they have come up with a suitable means of combatting the greedy birds. Queletox is the name given to this chemical "miracle weapon", which has a highly toxic affect on weaver birds but has practically no toxic affect on people or other birds and animals.

Plant protection and the preservation of the environment are thus not poles apart when it comes to the purposive combatting of the weaver birds, a real pest. The rest of the environment sustains no damage unlike the use of notorious DDT against tsetse flies. The side effects of this poison sprayed from aircraft and helicopters caused enormous damage and the ecological balance became unhinged.

The GTZ is also out to get the Great Corn Borer by means of a biological integrated application. The pest appeared in Tanzania at the end of the 70s - brought in from the Central American state of Costa Rica and mainly attacks maize pods stored in the traditional fashion. It is not possible to combat the borer by purely chemical means because this would necessitate a new storage method which would take up considerably more space. The GTZ approach therefore is aimed at rendering the pest harmless through natural enemies and other factors, which will restrict its reproduction. The Eschborn-based GTZ is first of all attempting to come up with an answer in Costa Rica, the original habitat of the Prostephanus truncatus. Afterwards, the transferability of the method will be examined by comparing the ecological systems of East Africa and Central America. If this comparison turns out to be positive then an attempt will be made in further phases of the project to reduce storage losses to a tolerable level - damage amounting to 27 million dollars was caused in Tanzania alone in 1985 - by introducing natural enemies of the insect. Combatting pests in particular, is one field where biotechnology - the integrated application of biochemistry, microbiology and process engineering - offers the Third World major chances to improve their capacity to produce their own foodstuffs. Of course, certain biotechnological methods, such as fermentation processes, are used traditionally in many developing countries. However, knowledge of biotechnological methods including gene and enzyme techniques are still almost exclusively the preserve of the industrial

countries. And the extent and the pace of further developments serve to open up the gap in technological know-how between North and South even further.

Biotechnology in particular, affords outstanding possibilities for the developing countries in the fields of energy, nutrition, fertilisers and the health service. New developments, for instance in breeding more resistant sorts of plants with greater yields, in producing, processing and preserving foodstuffs, in the winning and opening up of raw materials and medicines have increased chances to improve living conditions in the Third World in the long term. Biological agents designed to combat disease and pests made from vegetable-based substances such as pyretheum or neem are already being used successfully today.

However, biotechnologies in the developing countries still encounter obstacles: a lack of research facilities and a restricted number of experts as well as the high costs for application-oriented fundamental research stand in the way of independent developments of biotechnological methods. Apart from practical use in Technical Cooperation, the Federal Republic of Germany consequently is engaged in assisting many developing and threshold countries to set up and extend their national research capacities and to train and provide advanced education for local experts. In addition, it contributes towards reducing the technical and economic risks in developing biotechnological methods as a result of the close cooperation between German research and development institutions and those in the Third World partner countries.

Old and new Whim Technique - an Alternative to Manual Labour

"A whim? Never heard of it". Students of ethnology at the University of Münster knew as little about the word as the average citizen in the Federal Republic of Germany. Notwithstanding, whims (or gins) are an ancient form of traction for machines (threshing machines, water drawing machines, etc.), which were used - also in Germany - far into the present century, making use of the power of animals. In some cultural spheres, whims still represent an important aid for agriculture: in Egypt and Morocco for obtaining water, for pressing oil in India - whims are used for milling, threshing, mixing and for pressing hay and cotton.

But first steam, then later electricity and the internal combustion engine appeared to obscure whim technique. However, the energy crisis of the last decade or so, which also managed to place many developing countries in a deep crisis, saw the tried and tested whim method resorted to, especially as - in particularly in Africa - there is a considerable potential of unused draft animals. Around 90 per cent of the draft animals there are used for working the soil, but they are not nearly as important for transport purposes. The "waste of energy" is enormous; for the animals are required only on some 40 days a year.

The German Appropriate Technology Exchange, known as GATE for short, which is a division of the German Agency for Technical Cooperation (GTZ) in Eschborn, is thus propagating the whim, where other propulsive energies are lacking or are relatively expensive.

The old - and new whim technology is characterised by low costs for investment, operation and maintenance. It saves foreign exchange and can be produced and serviced locally. Advantages which the inhabitants of the little village of N'Gan, not far from Senegal's largest city Kaolack, are already aware of. At the beginning of 1985, the 240 inhabitants saw the GTZ/GATE whim project in the neighbouring village of Loumbel Kelly. A whim mill had been set up to mill millet there. The N'gan women's organisation soon expressed the wish to have a mill of their own to carry out the time-consuming and exhausting work involved when millet is pounded in the traditional way. In August 1985, the millet mill was installed on N'Gan's village square. Every woman contributes some 2 DM per month for using it so that the purchasing costs of roughly 2,400 DM are redeemed. So far around 20 whims have been set up in this way in West Africa, mainly in Senegal and in Burkina Faso. However, there are an increasing number of women in the Central African Republic and Sierra Leone as well who have been able to convince themselves of the advantages of this old and new method.

Purposeful Development - only in Accordance with Nature

No one has up till the present time been able to find out why the legendary continent of Atlantis sank beneath the waves and whether it actually existed in the first place. In Togo's case, however, it is no secret why the coast is slowly but surely falling into

the sea: experts are convinced that the Akosombo Dam on the River Volta in neighbouring Ghana is to blame. The journey along the picturesque, palm-lined coastal road in Togo is one of the West African state's tourist attractions. However, the visitor's enthusiasm for the beauty of the landscape is abruptly jolted; for the coastal road suddenly disappears: what was an asphalt strip only a few years ago has been replaced by the waves of the Atlantic.

Since 1980, the sea at some places has eaten well over 100 m into the land. Historic buildings are in jeopardy, palm-oil plantations flooded and now the water threatens to destroy the pier from which Togo's most important export - phosphate is loaded. The experts believe that the reason behind the coastal erosion is that: the Akosombo Dam, completed in 1965, retains the major part of the sediments, which formerly were carried from the interior of the country to the Gulf of Guinea by the River Volta. Once deposited along the coast, these sediments counteracted the erosive effect of the waves.

Major reservoirs such as the Akosombo, no matter how necessary they often might be in overall economic terms, also conceal many other acological dangers. If the vegetation is not properly removed before damming takes place, then an overabundance of nutritive substances in the water can have in some cases, catastrophic consequences for the stocks of fish. Spawning grounds are destroyed, as the quality, temperature and current speed of the water change. Essential movements of fertile mud are prevented, which is needed as the basis for agriculture for the people living further downstream. Furthermore, stagnant water provides the favourite habitat for carriers of diseases such as malaria or bilharzia. The natural balance of entire river ecological systems is destroyed by the construction of dams.

In the Brazilian state of Paraná, where many reservoirs and power stationes were set up, the German Agency for Technical Cooperation (GTZ) is involved in a project which is designed to limit the negative influences on the environment in conjunction with the planning, construction and operation of dams. Apart from the compilation of a planning manual, the investigation of ecological and hydrological problems, the setting up of an environmental data bank and a documentation and information system is also foreseen.

Like the erosion along the Togolese coast, the continuous spread of the Sahara has partly been brought about by human hand. Through the over-utilization of pasture-land and deforestation, desertification has speeded up at an alarming pace. In Tahoua in Nigeria for instance, millet was grown before the famine catastrophe of 19 , subsequently, there was at least grass for the animals. But since the late 70s, nothing grows in Tahoua any more, the sand has buried everything below it.

High population pressure and interrelated developments such as scarcity of land and urbanisation have led to lasting, irreversible disturbances in the ecological balance in many African Sahelian countries.

The Federal Republic of Germany is aiding the affected states to stop the encroaching desertification with a whole range of projects - one standard project is not possible on account of the different ecological conditions in the Sahel. The pilot project "Combatting Desertification in the Sahel" carried out in cooperation with the "Interstatal Committee for Combatting Drought/ CILLS" is of especial significance here. Through developing and testing improved soil utilization methods (agro forestry, measures designed to conserve soil and water, cultivation projects, etc.) it is intended to contribute towards the effectiveness of projects combatting desertification.

(IN-Press)

Translator: Roy Forbes

State Development Aid from the Federal Republic of Germany

Development Aid Budget 1987 - total 6.9 billion DM

Regional Distribution

Africa	1.8 billion DM	(43.6 per cent of allocations)
Asia	1.5 billion DM	(37.4 per cent of allocations)
Latin America	536 million DM	(13.2 per cent of allocations)

Sectoral Concentrations

Satisfying Basic Needs	1.8 billion DM
Rural Development	1.7 billion DM
Measures on the Energy Sector	830 million DM

Further Major Aspects:
Training and Advanced Education
Protecting natural Fundaments of Life
Percentage of the poorest and poorer developing countries with an annual per capita income of less than 400 US dollars benefitting from German allocations: more than 52 per cent

Overall Volume of New Allocations 1987: 4.3 billion DM
(9.1 per cent more than in 1986)

Source: Federal Ministry for Economic Cooperation

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GATE
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